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Interview: Al Watkins

1986 Pecora Award Winner and
Chief of USGS EROS Data Center

Allen H. Watkins received the William T. Pecora Award for 1986 on 6 May 1987 at the 11th Annual Pecora Symposium in Sioux Falls, South Dakota. He was honored for "outstanding contributions toward the understanding of the Earth by means of remote sensing."

Watkins has been Chief of the U.S. Geological Survey's EROS (Earth Resources Observation Systems) Data Center since its dedication in 1973. The Data Center is a national facility for processing, archiving, producing data, and conducting research related to the application of remotely sensed data and other forms of geographic information. The Center was originally established to receive, process, and distribute data from the U.S. Landsat satellites and to carry out applications research.

Watkins, 49, was born in Charlottesville, Virginia. He received a bachelor's degree in engineering in 1961 from Virginia Tech, then worked briefly on the Polaris Nuclear Submarine Program. From 1962-1973, Watkins served as a technical manager of spacecraft systems test and development and later as assistant Program Manager for Earth Resources at the NASA Manned Spacecraft Center in Houston, Texas, before joining the USGS as Chief of the EROS Data Center in 1973.

This interview was conducted at ASPRS Headquarters by Don Hemenway on 9 June 1987.

PE&RS: Since you have been involved with Landsat for so long, what do you think of what's going on on Capitol Hill?

Watkins: Confusion. Nobody's crystal ball is very clear in regard to what the administration and Congress are going to do with Landsats 6 and 7. Even as we talk, it's widely rumored that the White House and the administration are going to submit a single satellite plan again...a funding request for Landsat 6 that will go forward to Congress. Along with that will be a request for continued operations funding for Landsats 4 and 5 for fiscal year 1988. Without that request we won't have funds in Fiscal Year 1988 to continue to operate the existing satellites, Landsats 4 and 5, nor would the government have funding to continue to store and distribute any Landsat data, period.

The rumor, and I expect the fact by now, is that there will be a request from the administration to re-study the configuration and business arrangement for Landsat 7. It remains to be seen how Congress will react to this resubmission of a single satellite plan. As you recall, the Senate Appropriations Committee turned down the previous single Landsat plan from the Department of Commerce on the basis that it wouldn't provide adequate time for true commercialization to occur.

P&ERS: How has the transition been for the EROS Data Center?

Watkins: Once again, confused. We've diversified a good bit at the EROS Data Center. Although the Center was originally established in 1971 to process and distribute Landsat data, we have evolved into a large number of other activities. Current staffing at the Center is about 350 with an annual budget of just over $17 million.

As you know, the Data Center receives, stores, reproduces, and distributes USGS acquired aerial photography along with several types of geophysical and earth science data. We distribute data from the National High Altitude Aerial Photography Program and support the National Cartographic Information Center, or NCIC, of the USGS through a nationwide network of computerized information locations. We are a field center of the U.S. Geological Survey's National Mapping Division and we're involved in advanced mapping systems development activities. We do work in the development and application of geographic information systems and related technologies. We produce custom tailored derivative products of satellite and other cartographic and earth science data for a variety of different Federal agencies. We do some production digitizing of base category map data to populate the National Digital Cartographic Data Base being implemented by the USGS. We carry out research and development activities in image processing, image mapping, and do software development for both business and analytical systems. The Center has also recently implemented a capability to receive and process AVHRR imagery data from the NOAA polar orbiting satellites.

In addition, you may be aware that NOAA and the USGS have agreed that the USGS will operate the legislatively required long term archive of satellite land remotely sensed data at the Data Center and cooperate in land remote sensing research.

So in addition to worrying on a day to day basis about the processing and distribution of Landsat data for the Department of Commerce...in partnership with EOSAT these days..., we're into a variety of other activities. However, the commonly held belief is that our biggest job is still Landsat data handling. So as the Landsat program future is confused, so is our future at EDC.

In other words, the perception is that our primary job is handling Landsat data, and when the Landsat program has funding difficulties, then we tend to have funding problems with the Data Center's appropriations. The fact of the matter is that only about a third of our work at the Data Center is the handling, processing, and distribution of Landsat data. We are a significant user of Landsat data for research and applications, but in terms of NOAA support, it's only about a third of our activities.

PE&RS: How has it been working with EOSAT?

Watkins: The job we're doing these days hasn't really changed very much from the job we were doing through the 70's and early 80's. We still receive and process incoming Landsat data, accept customer orders, produce user products, and distribute the data, under an agreement with NOAA, and in cooperation with EOSAT.

PE&RS: In addition to going through the transition with EOSAT, haven't you also been moving from what was originally a NASA facility to being a NOAA facility?

Watkins: That's pretty accurate. The USGS and the Data Center started off as a partner in the Landsat program with NASA back in the days when Landsat was an experimental program and NASA was building, launching, and operating the satellites. The relatively raw data was then sent to EDC from NASA's Goddard Space Flight Center and we did the final data processing, user product generation, and distribution of data. NOAA and the Department of Commerce assumed responsibility for the program in 1983 under a mandate to evolve to an operational and ultimately a commercialized system.

We continued the same Landsat data handling activities, but using NOAA appropriations as opposed to Geological Survey funds up until the signing of the contract with EOSAT in September of 1985, and the job still hasn't changed much. We have two EOSAT and two NOAA production representatives on-site at EDC, and NOAA continues to reimburse the Geological Survey for Landsat data handling support and will continue to until EOSAT has their ground facilities ready in Lanham, Maryland.

PE&RS: If Landsat is only a third of what is being done at EROS these days, what are some of the GIS projects you said are being worked on?

Watkins: We have a broad spectrum of work underway in geographic information systems technology...from the development of data standards and exchange formats to the development of interface software that will allow you to reformat and integrate data from both raster and vector structured systems. In cooperation with the other bureaus of the Department of the Interior, we are developing resource information systems for a variety of natural resource management applications. We are developing the prototype of a Federal Lands Information System, a geographic information system with information on ownership restrictions, resource potential, and a variety of other data of Federal lands. We are working overseas with the Agency for International Development on development of Famine and Early Warning Systems for drought and grasshopper infestations in Africa.

We also carry out research and applications development with our sister divisions within the Geological Survey. In cooperation with the Geologic Division, the Center supports the Continental United States Mineral Appraisal Program, CUSMAP, using spatial data and mathematical models of the various parameters associated with the probability of occurrence of minerals for specific areas of the U.S. We have a field office in Alaska that has been highly successful in transferring remote sensing and GIS technology to the various Federal and State resource management agencies there.

PE&RS: There's a big debate about how the data will be handled in the future and compatibility between systems. How are you folks addressing that?

Watkins: Certainly everyone is interested in establishing the data structures, standards, and exchange formats for digital spatial data and geographic information systems. The Geological Survey's National Mapping Division is playing a major role in establishing these standards for base category map data...along with the Federal Interagency Coordinating Committee for Digital Cartography. These mechanisms, although they are only a few years old, are in place and are working towards establishment of standards and exchange formats.

PE&RS: What computer systems are you using?

Watkins: We have a variety of computers at the Center including VAX 11-780's, older DEC 1100 series computers, SEL 32/55's, 32/77's, and 32/87's, several Gould UNIX operating system computers, and a Burroughs 6900. We have a major interest in transportability of software. We have the same problems that everybody has...every time you have a hardware generation change you run into major software conversion problems. We are emphasizing UNIX based hardware and software systems which we believe will give us improved transportability of software and hardware independence.

PE&RS: Are you looking at any of the commercial systems? ERDAS or ESRI's ARC/INFO?

Watkins: Both of those. We use ESRI's ARC/INFO system in a large number of applications. In addition, we also are using MOSS and other nonproprietary GIS software.

We are developing, in conjunction with NASA's Goddard Space Flight Center, a raster image processing and analysis system known as LAS. We have a large investment in LAS, and it is going to be a real work horse for raster data analysis and image processing, particularly when it's converted to run under UNIX with an increased level of hardware independence.

PE&RS: Is that something that could possibly become available to the public? Since it's nonproprietary and a government developed piece of software, right?

Watkins: It will be available to the public. It is now, in its earlier stages through NASA's COSMIC system. The difficulty is, I'm not sure that anybody in the government is really set up to support it...support it in terms of continuing maintenance and response to user needs.

There's also additional development work that has to take place. We're some ways from having a fully developed UNIX based LAS. We have finished the majority of the original job we set out to do. This was to develop a versatile raster image processing system running under VMS. We've got a ways to go before we have the full system with all the applications modules operating under UNIX and have it appropriately documented and available to users.

PE&RS: Who's doing the UNIX conversion? Is that a project of yours?

Watkins: Yes, we're continuing to work with NASA, but a lot of the conversion is taking place at the Data Center.

PE&RS: What are some of the digital cartography projects that you are involved in?

Watkins: Two general categories of work. As you know the USGS has embarked on a major program involving modernizing the basic way we make and revise maps...including creation of a National Digital Cartographic Data Base. The digital cartographic data base will serve two purposes; it will serve as a base of information from which to revise and make new maps and it will also be a user product in itself for people and organizations who want digital cartographic data for use in computerized geographic information systems. As an element of the National Mapping Division, we are helping to develop some of the software that will be needed for the new map production system that the National Mapping Division is implementing.

We are also doing some of the production digitizing to populate the National Digital Cartographic Data Base. In this area, EDC does enough production digitizing to understand the mechanics of the process so that the Center is in a position to contribute to the development of needed software for the advanced mapping system being developed. We also need to understand the

standards being established for the Division's digital cartography program. However, the predominant amount of production digitizing is done at the traditional Mapping Centers of the Geological Survey at Reston, Rolla, Denver, and Menlo Park.

PE&RS: You talk about building or designing an advanced mapping system -- what do you think that advanced system will be like?

Watkins: Well, I'm not sure I'm the best individual to go into a lot of detail on that. The National Mapping Division's implementation of digital cartography and development of an Advanced Cartographic System is an important effort to modernize and improve the efficiency of the map making process. Older cartographic production equipment will be replaced by newer state-of-the-art hardware and software capable of producing digital and graphic products. It really is a sweeping change in the National Mapping Division's map production and revision process.

PE&RS: What do you see down the road for the Data Center, say 5 to 10 years in the future?

Watkins: The Center is still the primary Department of the Interior and Geological Survey facility for remote sensing research and applications development, and for working with NASA and NOAA with this technology. That's an important role for the Center, and I see it continuing. In a very real sense, the Data

Center continues the EROS role of coordinating and integrating Department of the Interior requirements for remotely sensed data and remote sensing imagery is of course an image data layer for any geographic information system. Remote sensing and GIS are a natural technological marriage.

I think how these things play out are going to be determined largely by the course the U.S. Civil Satellite Land Remote Sensing Program takes and that's tough to forecast these days. The U.S., in satellite land remote sensing, has embarked upon a policy experiment, and I don't know where that policy experiment is going to end up. I am skeptical about the practicality of commercialization. Fully commercializing Landsat, without continued government financial support, may be like trying to teach a turtle to dunk a basketball. It can't be done and it only confuses the turtle. I, like many users of the data, don't really care an awful lot who operates the system, whether it's the government or whether it's a commercial entity. But I am very skeptical about the possibility of achieving full commercialization, free of continued government financial support.

PE&RS: So long as you can get your hands on the data?

Watkins: Yes, as long as the data is available. I believe that commercialization with the classic definition of generating revenue from sales that's large enough to pay the bills of operating a Landsat type system is not going to happen in our lifetime. It's going to require some continued government

support. If you look at data sales today, and you compare those with the total cost of operating a Landsat type system, you're going to find that you're going to either have to sell 10 to 20 times as much data at today's prices, or you're going to have to sell the same quantity of data at 10 to 20 times the price.

PE&RS: And you've already got professors complaining about the prices you're charging now, right?

Watkins: We've already got more than professors complaining. We've got government and private organizations that are having difficulty dealing with the data prices. The fact of the matter is, that it is a high cost technology. It's an expensive technology. The data are expensive, the satellites you build to acquire the data are expensive, and the hardware and software you use to analyze the data are expensive. There are only a few proven general categories of use where the data is truly cost effective, if cost effective is the right word. One, of course, is data of geographic areas where you just can't easily obtain data of any other kind...data over foreign countries for foreign economic intelligence purposes. There's no other readily available source of information and the cost effectiveness or cost-benefit equation gets warped when you have no other way to get the information...in other words, it's more effective than other ways to get the data because there are no other ways to get the data.

Second, is the support of global earth science studies. Clearly, if you're going to have a consistent and uniform data

set over the entire globe, a satellite is the only way to go...and the cost effectiveness equation gets warped again in the area of science. Third, is an application that will surely grow in importance...the global assessment of critical minerals and energy resources necessary for our future. Here again, the criticality of need for this kind of information warps the cost effectiveness equation.

I should also mention another very critical aspect of a U.S. presence in civil satellite land remote sensing and that is protection and continuation of an open skies policy. I am very much afraid that if the U.S. does not continue a presence in satellite remote land remote sensing, other countries may move toward policies other than open skies and nondiscriminatory data availability.

There are certainly other benefits...spin-off benefits from the Landsat program. By spin-off benefits, I mean the Apollo program and teflon frying pan argument. If somebody else is paying the full cost of the satellite system, then certainly the Bureau of Indian Affairs can use the data or the National Park Service can use the data, and <u>are</u> using the data, for natural resource assessment. But if required to pay the full share of the system cost that might truly accrue to them, there are other ways they can get data that are more cost effective. Fundamentally, I think that the country has got to decide whether Landsat is, or is not, a worthy national asset when considered from a national security viewpoint, from an earth sciences viewpoint, from a critical resource assessment viewpoint, and from a foreign policy perspective.

National security, development of critical mineral and energy resources, global earth sciences, and foreign policy don't fit cost benefit models very well...but we are going to have to decide from these perspectives whether the civil satellites and systems are worth continued government subsidy, or we are going to have to simply back off, hopefully continue experimental satellite remote sensing activities, and very possibly search out some answers in international participation and cooperation. One thing that I feel particularly strongly about is that we should not confuse U.S. involvement in the technology in its entirety with Landsat. Although Landsat is terribly important to the technology, they are not one in the same.

Should the commercialization policy experiment fail and should Landsat data not continue to be available, either after Landsats 5, or 6, or 7, there still is a need to continue to pursue the technology within the U.S.; there will still be satellite data from experimental missions and from other countries that we will need to obtain to continue development of the technology. It may well be that the solution is ultimately an international partnership of some kind, rather than competitive market-driven commercial operations.

PE&RS: There is already talk about that, at least for the media, where the possibility of some of the television networks coming together to put up money is mentioned -- a MediaSat. Some folks have said, if they're willing to spend $40 or $100 million to buy the rights to an Olympics they can put up maybe a few hundred million with a couple others to put a satellite in orbit.

Watkins: I don't buy that argument. In my opinion, MediaSat makes interesting discussion, but not economic sense. To compare the cost of a $500 to $600 million satellite system that would come anywhere close to doing what the media needs and wants, with spending $100 million for Olympic coverage is misleading in my view. The network Olympic coverage time is already sold or will be sold to advertisers and the media is simply acquiring the rights to coverage with somebody else's money, and with a profit.

That is not the case with an investment in satellite systems. When you spell out the likelihood of being able to obtain the coverage the news media wants, when they want it, with the resolution needed, and then put an appropriate price tag on it, the media executives that I've talked to suddenly loose interest. MediaSat is an interesting First Amendment issue. It's an interesting argument from a Constitutional and legal standpoint as to what the media should and should not be allowed to do. But, I personally think that a MediaSat is just that, an interesting idea to kick around. It will utlimately happen, but I don't look for a MediaSat to happen for a long, long time. I do believe however, that you will see increasing use of available civil satellite data by the news media. If the term Mediasat is simply used to define a mechanism or entity for obtaining satellite data for news purposes, ok, but if it means a dedicated satellite and system, not in the near future.

PE&RS: Since you were involved with selecting EOSAT, how do you feel about how the process has worked out?

Watkins: That's a toughie. The process has probably worked out just about the way we should have expected it to work out, given the difficulties with the budget deficit, and the need for additional funding for Landsats 6 or 7. There are some things that have happened that none of could have foreseen, the Challenger accident, which has affected launch vehicle planning and run-out cost of the EOSAT contract.

The broader commercialization policy experiment is particularly tough. It's going to take time to assess whether it's possible to develop an adequate market for data products along with the associated revenue or whether in fact this is all a pipe dream.

In my opinion it's going to require government financial support for a number of years, and we'll have to see how the policy of this administration and future administrations comes down on programs of this type. Programs which basically need to be approached as national assets; in the same sense that weather satellites are a national asset; in the same sense that the national census and topographic maps are, to a large extent, national assets that require continuing government support. If the U.S. is going to make decisions on the basis of the program's behavior as a commercial enterprise, then I'm very worried about its future. If we're going to make decisions on the basis of its broader national benefits, then I think a strong case can be made.

PE&RS: Going back to the transfer, you said that things have worked out pretty much as we might have projected. Do you think we could have foreseen the government not paying the monies out

that they promised to pay? I mean, that's been the big crunch, the real problem. Why do you think EOSAT would go into it if they didn't think they were going to get the money they thought they were going to get?

Watkins: Commercialization of Landsat was a policy compromise from the start. The position of OMB was that the commercialization process would take the program completely off the Federal budget. They had hoped they would get such a response from industry.

PE&RS: And yet they had two companies back out, right?

Watkins: Actually, it was Kodak that backed out in the final selection process when faced with a $250 government support limitation.

PE&RS: Wasn't the money cut and they said "We can't do it for this amount?"

Watkins: Well, yes. And you see, OMB's desired goal of commercialization was zero additional government payment from word go. Then they got proposals that looked more like a requirement for $750 million in government funding or very close to what it would have cost the government to continue the program for six years. The compromise that was reached was one of saying "Hey, we're going to give you $250 million, and that's the limit that we will provide over whatever period of time."

The government committed itself to $250 million in future payments and was not particularly happy, but that was the best deal that could be made.

On the other hand, NOAA, NASA, USDI, USDA, and other users found themselves in a position where it was either commercialization or nothing as far as continuation of Landsat was concerned. So you end up with commercializing Landsat, but with two very different goals. One to cut government funding to zero as quickly as possible, and the other to continue the program. The increasing Federal budget deficit problem and cost escalations caused by spacecraft configuration and launch vehicle changes following the Challenger accident also focused more attention on the subsidy arrangements of the EOSAT contract.

NOAA and EOSAT changed spacecraft configuration plans several times...from a TIROS spacecraft bus, to an Omnistar concept, and back to TIROS. Launch of Landsats 6 and 7 was to be on the shuttle, and NOAA had commitments from NASA for two shuttle launches for roughly $35 million for both, which later evolved to Titan-II launches at $50 million each, and the administration said, "Hey, we don't think continuation is worth it."

The government finds itself ill-prepared to continue the subsidy and EOSAT will only continue the program with continued government subsidies. How the compromise is going to work out, I don't know. My hunch is that we'll see the commercialization policy experiment continue through one additional satellite, and then we may have to rethink the future...and by the way that has

been the history of Landsat since the beginning. But, let's don't throw U.S. pursuit of the technology out with the commercialization experiment.

PE&RS: That's what I've heard several people express, that if EOSAT washes up for one reason or another, they figure the government has got to get back in it some way or another. They're going to have to put satellites up. Do you feel that way?

Watkins: I feel that the technology should continue. If the only U.S. option is to move back into a government operated Landsat program, as much as I would like to see Landsat continue, I don't know if that will happen or not. I tend to believe that increased international participation and cooperation in land remote sensing may make more economic sense.

This could take a form similar to the World Meteorological Organization type of activity where you have close coordination of sensor and data performance parameters and free and open exchange of data and information between countries. I don't presume to be able to forecast or predict the specific institutional arrangements, but I do believe that the Federal government is either going to have to agree to continue to financially support the Landsat program or we may not have "operational" satellites in the U.S. for some time. It may be that we will continue with shuttle and eventually space station polar platform based experimental sensors and optimize our access to foreign satellite systems.

PE&RS: Are you getting data from SPOT? Are you looking at their material?

Watkins: The USGS has contracts in place for both EOSAT and SPOT data, and can procure EOSAT and SPOT data for any Federal agency that chooses to use the service. We are working closely with both SPOT Image and CNES, the French space agency, in research and exploring application of SPOT data. SPOT has some intriguing application possibilities with its pointability, which gives you more frequent coverage for the recording of dynamic and rapidly changing events, and quasi-stereo abilities. The opportunity for acquisition has always been a big problem with a satellite like Landsat with sensors welded to nadir. You're rarely over the right place at the right time, and if you are the clouds are there. The Chernobyl image acquisitions by Landsat were an infrequent kind of thing. Pointability increases data acquisition opportunities and helps a lot. Ten meter ground resolution also helps. SPOT obviously doesn't have the multispectral capabilities of the Thematic Mapper and that's a drawback. Expanded multispectral characteristics are important, but the guy who says the spatial resolution is not important, never analyzed any data. It is very important, but obviously must be traded off with swath width, frequency of coverage, downlink data rates, and system cost.

PE&RS: There is another Landsat-related problem of concern to many ASPRS members, and that is conversion of some of the older MSS Landsat data. Has funding been made available for that yet?

Watkins: No, it hasn't. NASA has been funding the conversion, high grading, of scenes of Landsat data from 1972 to 1978. From 1978 on, all of the MSS data are in digital form at the EROS Data Center and we'll continue to make it available. Prior to 1978 the data exist on wide-band video tapes and NASA has been converting selected scenes to CCT's. There are about 2 to 3 years of unprocessed data still to be converted, and NASA has now run out of funds necessary to continue the conversion.

NASA announced more than a year ago that they would not be able to complete the job. NOAA came up with, my recollection is, $500,000 to continue the operation for an additional 5 or 6 months. NASA has now stopped processing the data, and you really have two problems. You have a problem where the data are on wide-band video tapes and no other system can process it, and in addition the tapes are slowly degrading. The systems that are available at NASA for the conversion are 15 year old Xerox computer systems.

The USGS, the EROS Data Center, has offered to work jointly with NASA and NOAA to transfer all of the old tapes and systems from the NASA Goddard Space Flight Center to Sioux Falls, where the Data Center would store and preserve the data and critical hardware necessary to process the data.

PE&RS: So that at some point in the future somebody could go in and perhaps try to work it?

Watkins: Yes, step two would be to reestablish a processing line to continue the conversion. We may be close to an agreement

between NASA, NOAA, and the USGS to come up with funding to allow this to happen.

PE&RS: You spoke earlier of the possible evolution of an international organization to handle remote sensing capabilities. Could you perhaps hypothesize about what such a group might be like? Would it be run by a consortium of countries. Do you think it might be something like ESA, the European Space Agency?

Watkins: As I said before, I really can't hypothesize the specific organizational and institutional arrangements of an international program. I doubt seriously if it would look like an ESA. I doubt that you would have a number of countries joining together to jointly fund missions. I guess I see a possibility for different countries to pursue certain speciality areas,...for example, one country would pursue radar satellites and another country would pursue ocean color types of sensors, and another country would work with narrow band imaging spectrometry from space.

As long as an open skies policy is maintained internationally and countries can exchange data freely, then what is lacking is the necessary international coordinating bodies. The other thing we lack, quite honestly, is any serious discussion of international alternatives. The commercialization policy of the U.S. and the French is not encouraging international cooperation in any way that I can see. The important ingredients of open skies and open availability of data are there, but with competitive market driven objectives. In

many ways, commercialization policy constrains arguments that might be developed for international cooperation.

We'll have to wait and see what happens with Landsats 6 and 7, but the cost of the satellites and the global nature of the technology lead me to believe that there is reason for at least looking at increased international cooperation.

PE&RS: Can you say something about how national security is involved in Landsat? Do you think the Department of Defense is terribly dependent on the Landsats?

Watkins: There certainly are applications of civil satellite data that are of interest to DOD.

PE&RS: It seems to be known that DOD has been getting information from Landsat over the years, and that with the current troubles, they now have even gone so far to put part of the Air Force's budget money toward launching Landsat 6.

Watkins: The House Armed Services Committee authorized some $70 million for support of Landsat. That action took place in the House Armed Services Committee and it remains to be seen what the House and Senate Appropriations Committees will do with the authorization.

PE&RS: As Director of the EROS Data Center you obviously must do a lot of administrative work, but do you do any research yourself?

Watkins: No, not really. I was with the nuclear submarine program for a couple of years right after college, and then went with NASA in 1962 in the very early days of the Manned Spacecraft Center in Houston. I was in a variety of management jobs with NASA, primarily in flight systems test and development, until the first Apollo landing in 1969. About that time, I was getting tired of worrying about which valve was going to leak next, and NASA had an emerging aircraft and manned spacecraft earth resources program which in many ways led to today's civil satellite programs. I was involved in the management of the aircraft program, the development of spacecraft experiments, and management and development of NASA's Earth Resources Program from 1969 to 1973, and in 1973 when the Geological Survey's EROS Data Center was built, I moved to Sioux Falls as the Center Chief. So no, I've never been a hands on researcher in the field of remote sensing or information systems.

PE&RS: Well, you've been at Sioux Falls now almost 15 years, you've just gotten one of the big honors in the field, the Pecora Award. What do you see for yourself down the road? What do you want to be doing in 5 or 10 years?

Watkins: First of all, although the Pecora Award is a great personal honor, particularly coming from NASA and the Geological Survey, it really belongs to all the people at the EROS Data Center. They are the ones who earned it. In terms of the future, I would really like to see some constancy and some

order evolve from the current confusion in the U.S. satellite land remote sensing technology and I'd obviously like to see a clearer path and direction ahead for the Data Center.

From a personal standpoint, my family and I like Sioux Falls and the Midwest very much. I like to sail and, believe it or not, you can do that in South Dakota. I have a 36 foot sailboat which we sail and race on Lewis and Clark Lake, but one of these days, I expect we'll want to get on some more serious water. I was born and raised here in Virginia and maybe in another 5 or 6 years when the kids are through school, we'll move to one Coast or the other where we can enjoy the water and still be able to be involved with the Geological Survey, NASA, and the Space Program in some way.